

Sustainable Development Goals

Cut the power, save by the hour

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1. Introduction

Our project is about helping middle-class households **save energy and money** by using smart sensors and a mobile app. Our system makes it easy to track energy use, get tips, and build better habits through fun features and helpful advice.

2. Methods

Easy to use energy systems

Systems start with simple, plug-in sensors that help people see how much energy their home is using. It's affordable and can evolve over time, so users can add more sensors when they are ready.

App with easy to interact and fun features

All the data from the sensors goes to a mobile app. The app makes saving energy fun with challenges, rewards, and points.

Helpful reminders and customizable

The app sends smart tips and reminders, e.g. when to turn things off or use appliances at cheaper periods. Such nudges help users to save energy, simultaneously reducing financial hardships without much effort.

Community and eco-score

Users can choose to observe how they're doing compared to others through an eco-score leaderboard segment. This encourages "green/beneficial" competition and to act for the same purpose

Smart upgrade advices

Based on energy use, the app suggests upgrades like better insulation or a need to change an older system. It shows how much they cost, the amount of accumulated money in the future and how long it takes to pay off. Moreover AI chatbot segment lets the user discuss the best options.

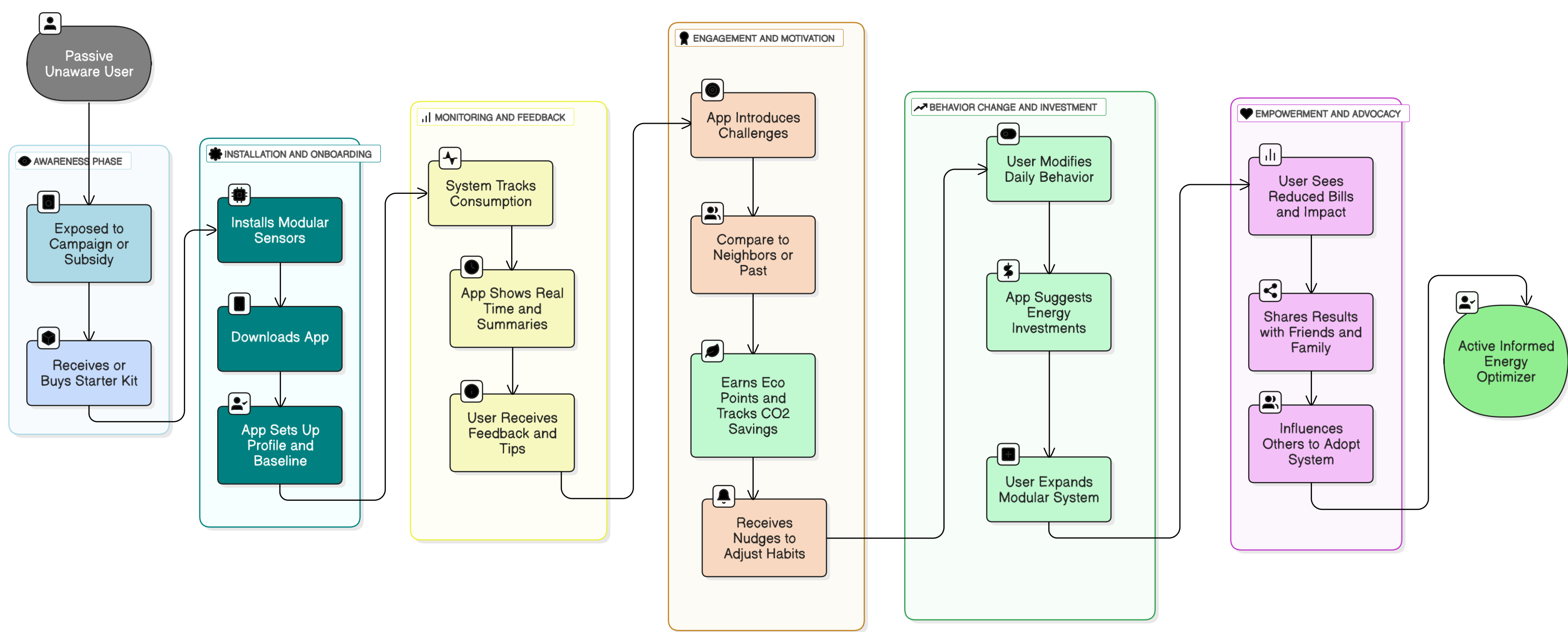


Fig. 1: Activity diagram

3. Research

Gamification

enCOMPASS

- 10-12% energy use reduction

Gaming for Earth

- 10 games
- -3.46% electricity usage
- -7.48% gas usage
- Some more effective than others

Meta-analysis

- 16 studies
- -13.6% to -57.7% electricity usage
- Up to -45% electricity usage

Nudging

Energy cost information

- The most effective motivator
- More important than CO2 emissions and energy usage

Social influence and self commitment

- Not effective in energy reduction alone
- Can be beneficial combined with other strategies

Fig. 2: Research summary

4. Dashboard

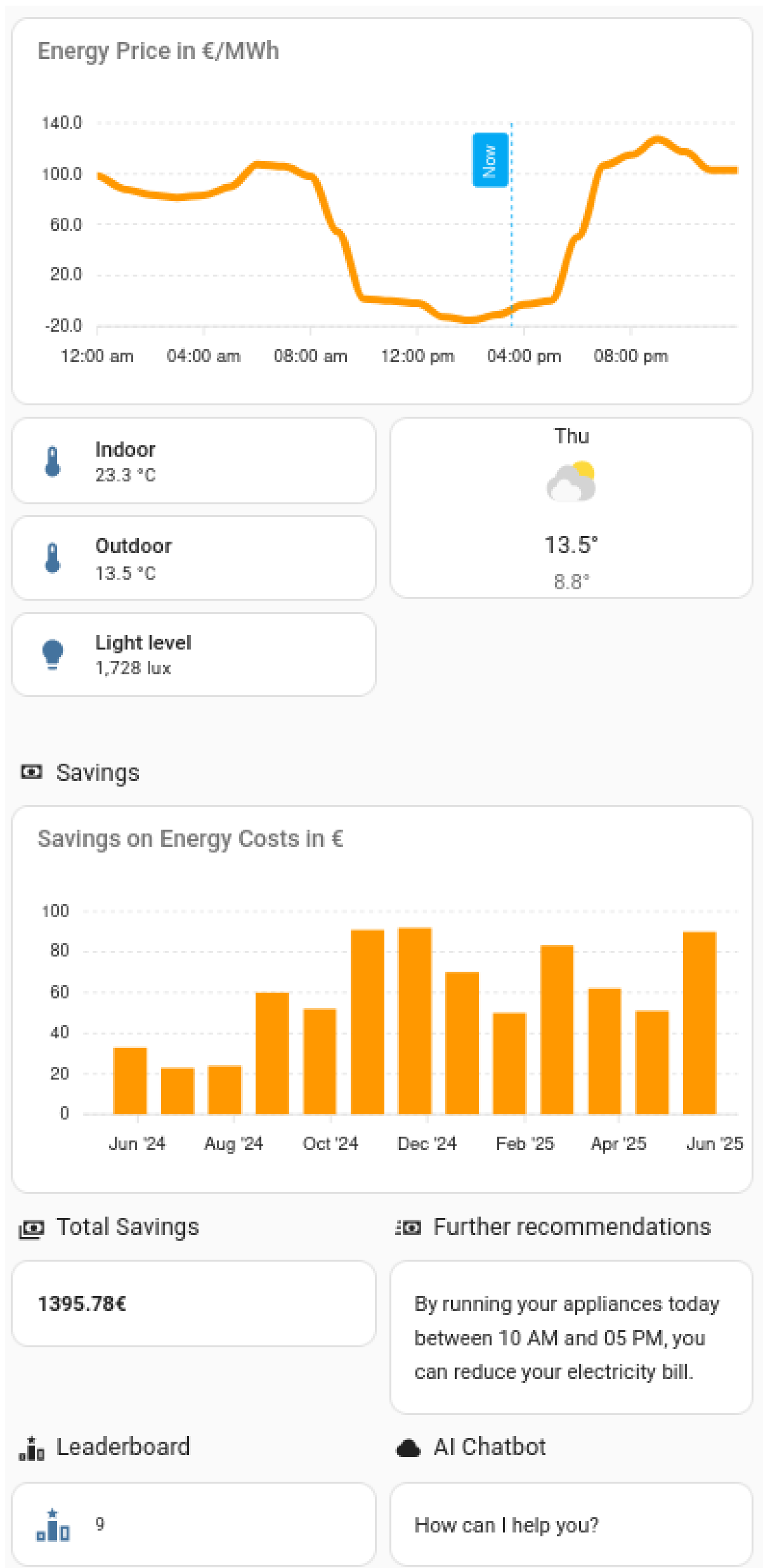


Fig. 4: Dashboard

5. References

- (1) "Nudging people to save energy in smart homes with social norms and self-commitment" (2019, May 19).
- (2) Richard G. Newell and Juha Siikamäki. (2014, December). Nudging Energy Efficiency Behavior: The Role of Information Labels.
- (3) Piero Fraternali* and Sergio Luis Herrera Gonzalez. (n.d.). Demo Abstract: enCOMPASS, demonstrating the impact of gamification and persuasive visualizations for energy saving.
- (4) Development of Energy Saving Application through Gamification-Factors: A Systematic Review. (2023, November).
- (5) Gaming for Earth: Serious games and gamification to engage consumers in pro-environmental behaviours for energy efficiency. (2017, May).



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The game to save energy!

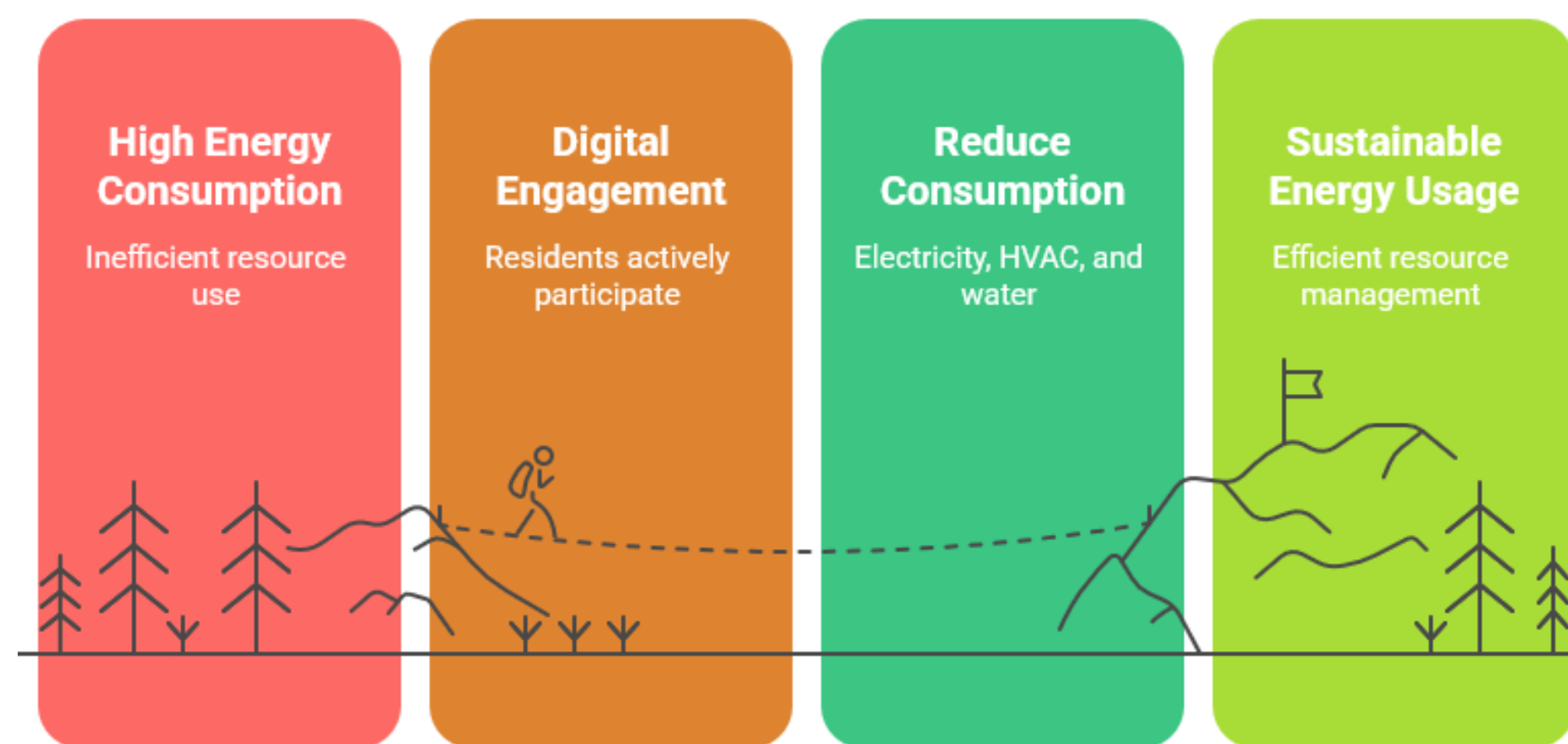
Engaging solution that fits your daily life

Adam Bilinski, Deimante Maciute, Bilal Oubelkas, Gabriel Kazdar, Ihor Abdullin, Noah Pack

Group 2

1. Introduction

This project targets residents of apartment buildings, aiming to transform energy usage behavior through digital engagement.



2. Methods

Development of a smart dashboard and mobile app to monitor real-time energy usage of the individual apartments.

- Users earn points for reducing their energy consumption. Points can be redeemed for rewards, such as discounts, vouchers, or small household items.
- A leaderboard displays users' performance compared to friends, similar apartments and city-wide and national averages.
- The app supports automated tracking, increasing data accuracy and user convenience.

3. Discussion

- The design of the system is based on behavioural science and energy efficiency research, showing that user engagement is critical for long-term energy savings. Studies indicate that gamified interfaces can reduce energy consumption by 4% to 42%, depending on user type, reward mechanisms, and data feedback frequency [1]. By transforming energy management into a reward-based challenge, users are more likely to participate actively and consistently.
- Each point earned symbolizes not just saved energy but a step toward sustainable behaviour change. This shows that motivators like rewards can initiate engagement, which can later evolve into motivation, especially when social features such as leaderboards and peer comparisons are introduced [1].
- Energy consumption data from the European Union in 2022 reveals that households consumed 26.9% of final energy use, making them a critical sector to address [2].
- Moreover, as AI technology advances, user behaviour can be modelled to offer personalized energy-saving recommendations, predict usage patterns, and detect anomalies, all of which help in achieving deeper reductions in consumption [3].

4. Dashboard and mobile application

The app is built on the Home Assistant platform as a smart dashboard for monitoring and managing energy usage in apartments (Fig. 1).

Users can:

- Track real-time power consumption of individual devices.
- Control devices remotely and set up automation routines.
- Sort and group devices by room for easy navigation.

The app includes a points and reward system that encourage energy saving:

- Users can earn Energy Points for reducing usage. They can be redeemed for discounts or small rewards.
- The app notifies users with personalized tips, about saving energy.
- With build-in leaderboard the scores can be compared with friends, similar apartments, or city averages.

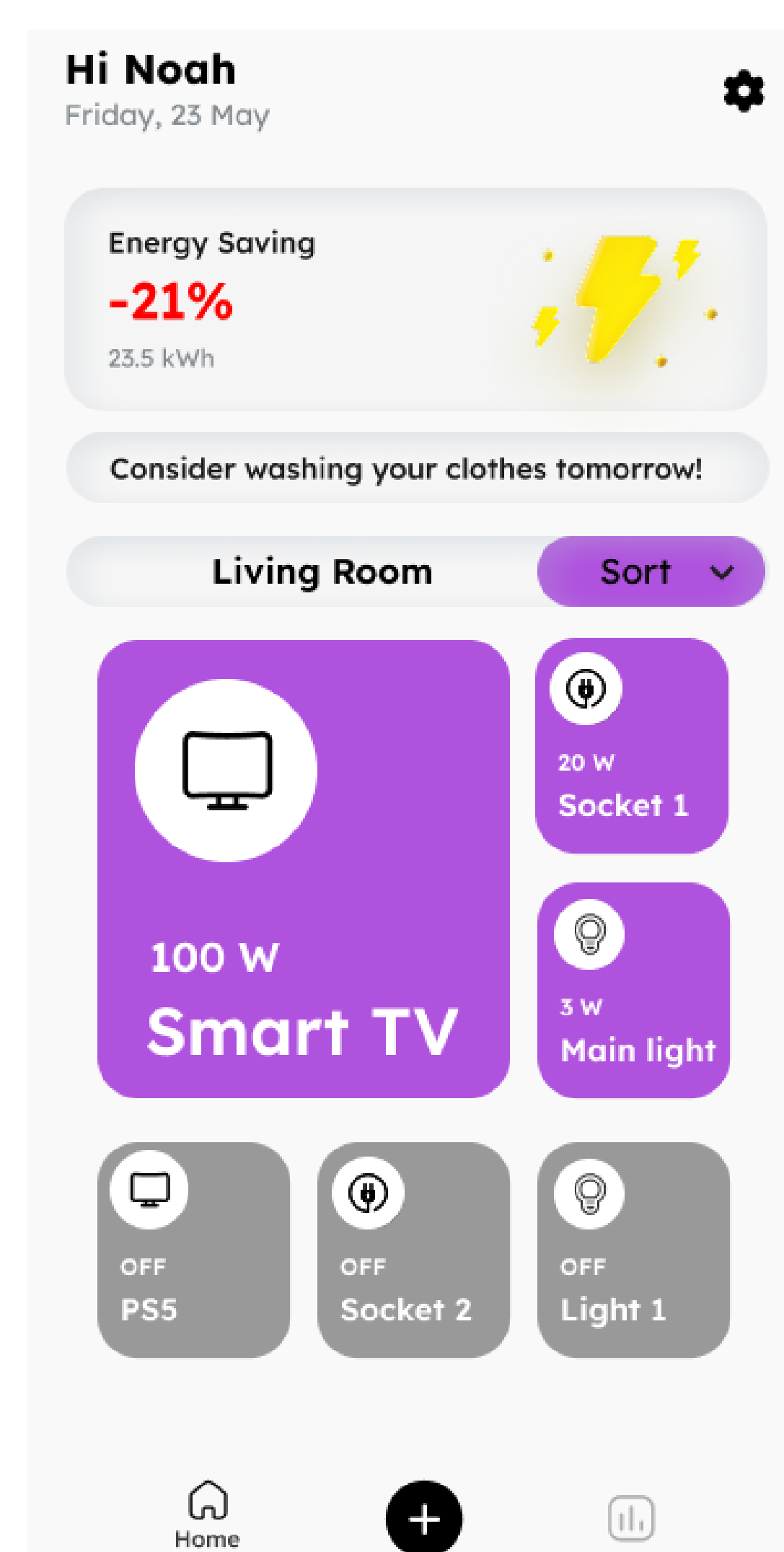


Fig. 1: Dashboard UI/UX prototype

Hi admin

Thursday, 22 May 2025

Consider washing your clothes tomorrow

Energy Saving

Apartment 1

45.98 %

Room Selection
Living Room

TV
153 Wh

Living Room Lig...
196 Wh

KNX Living Room shutter
Closed

Living Room Lights

Energy Usage

Apartment 1

5,094.0 Wh

Energy Saving Leaderboard

Apartment 1 — 45.98%

Apartment 2 — 31.41%

Apartment 3 — 26.15%

Fig. 2: Working prototype of the app made with Home Assistant

5. Point and reward system

To encourage energy efficiency, a reward and point system has been introduced. Participants are compared to the general population, with the comparison adjusted according to key parameters

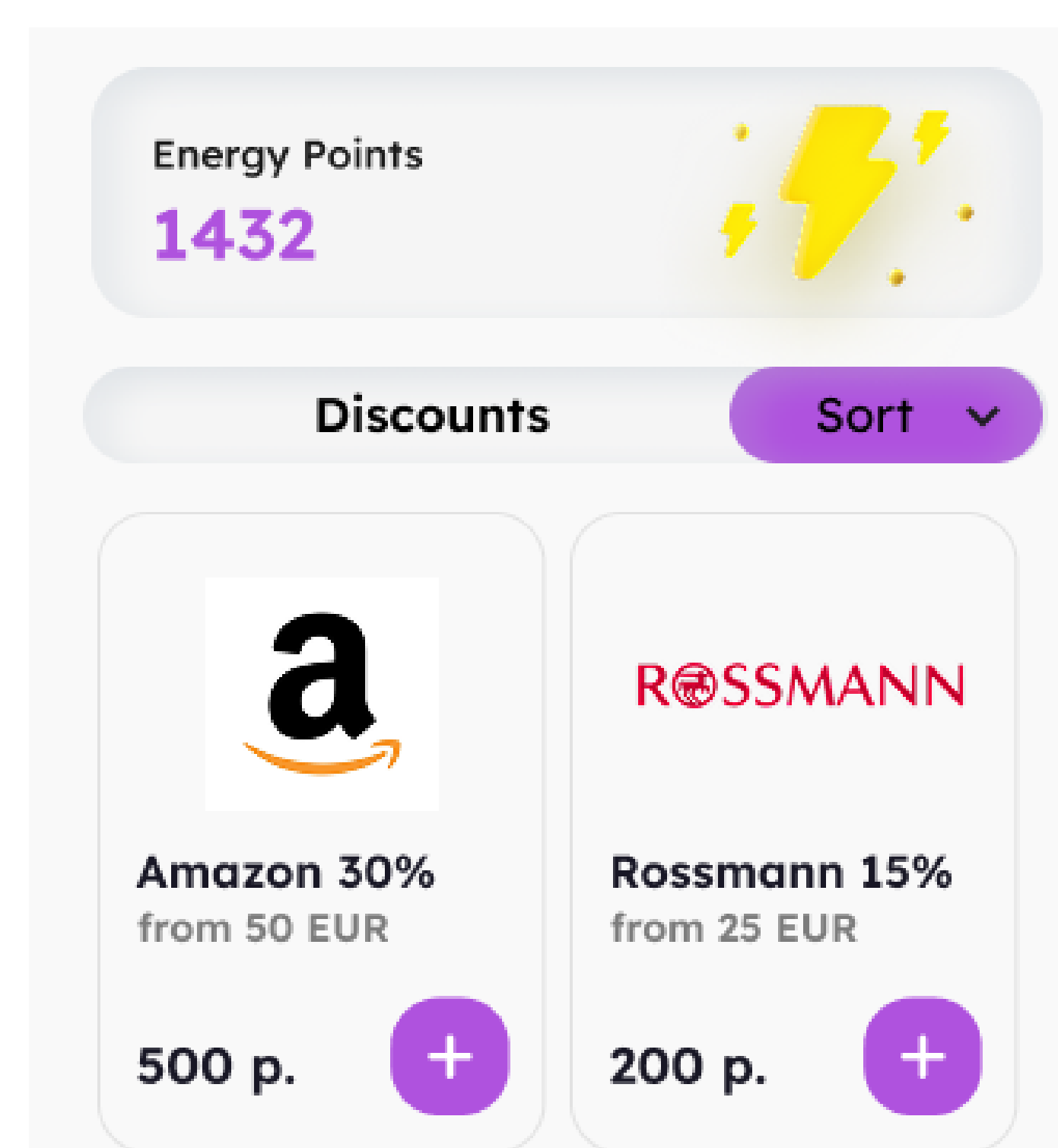
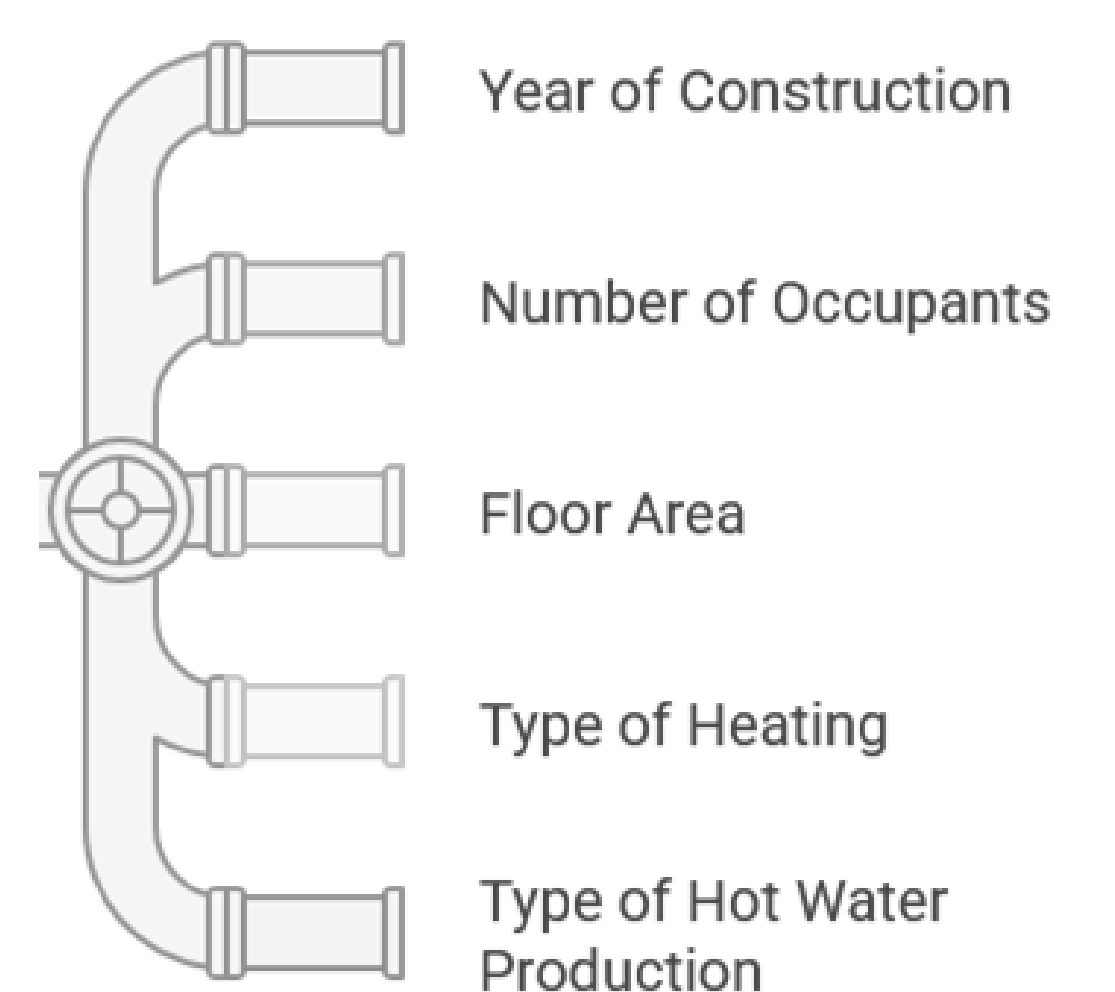
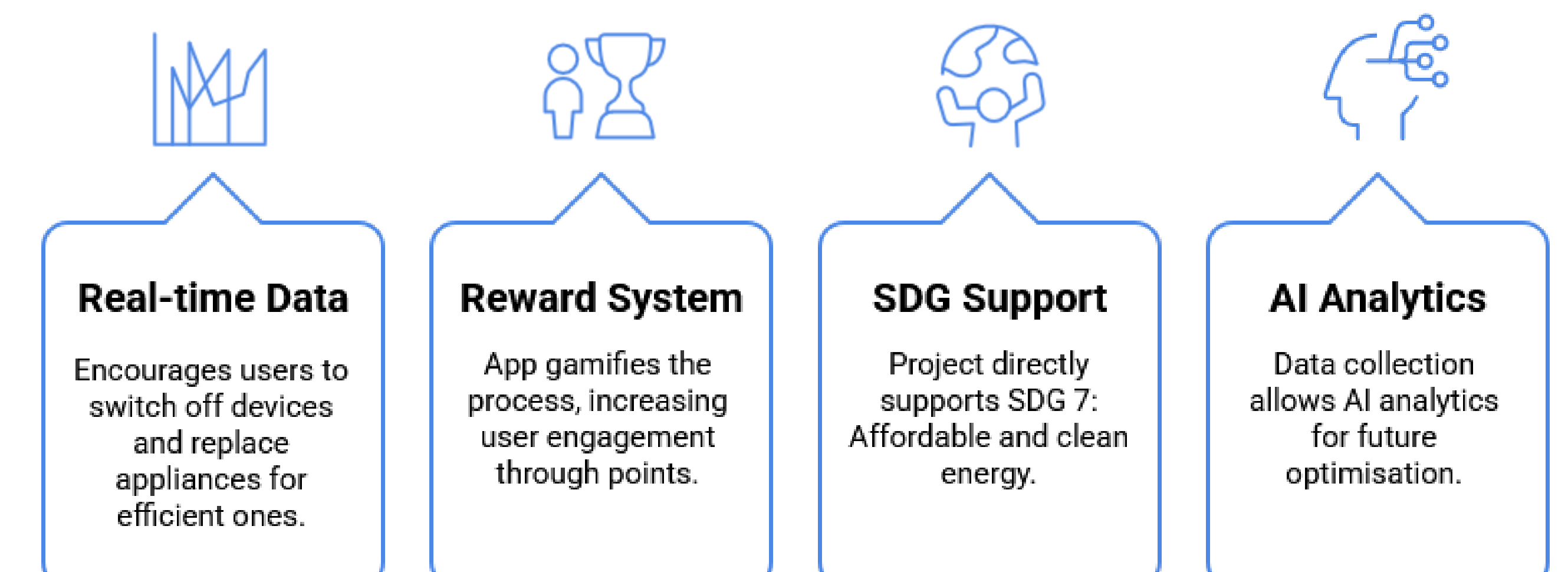


Fig. 3: Point and reward system possible implementation

If individual objectives are met, personal rewards such as discount coupons for stores are offered. Collective achievements can also benefit the community through shared gardens (with fruits and vegetables), support for local associations, or funding for water reservoirs. The discounts can be claimed by the user using the build-in shop.

6. Result and Outlook



7. References

- [1] N. Abdurahmanovic and A. Kallert, "Enhancing Energy Efficiency Through User Engagement and Behaviour Change: A Review on Gamification Approaches and Serious Games in Energy System".
- [2] "Final energy consumption in industry - detailed statistics" Accessed: 22.05.2025
- [3] B. Yan, W. Yang, F. He, and W. Zeng, "Occupant behavior impact in buildings and the artificial intelligence-based techniques and data-driven approach solutions," Renewable and Sustainable Energy Reviews, vol. 184, p. 113372, Sep. 2023.



Smart students-smart cities!

Track 4. Applied Smart Building Automation

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Team №3

1. Introduction

- Project focuses on **schools** as key public infrastructure.
- Target group: students divided into **two age groups** (primary, secondary).
- Main purpose: use smart technology to **promote energy awareness** and **responsible behavior** in a school setting.
- Linked to **UN Sustainable Development Goal 11** (SDG 11) – *Sustainable Cities and Communities*.

2. Methods

- 1) Dashboard design tailored to **age-specific understanding** and learning levels.
- 2) Tools used: **Home Assistant**, sensors (motion, light, temperature) mockups in **PowerPoint/Figma** for early testing.
- 3) Implemented **automation scenarios**: lights off when no one is present, air quality indicators, standby device detection.
- 4) Funding research through **government grants**, school budgets, CSR, and public-private partnerships.
- 5) **Pricing strategy**: aim for **average cost levels**, with funding support to ensure **social and financial accessibility**.

11

Goal 11

Make cities and human settlements inclusive, safe, resilient and sustainable.

10

Targets

24

Publications

130

Events

1280

Actions

Figure 1: Short introduction of SDG 11

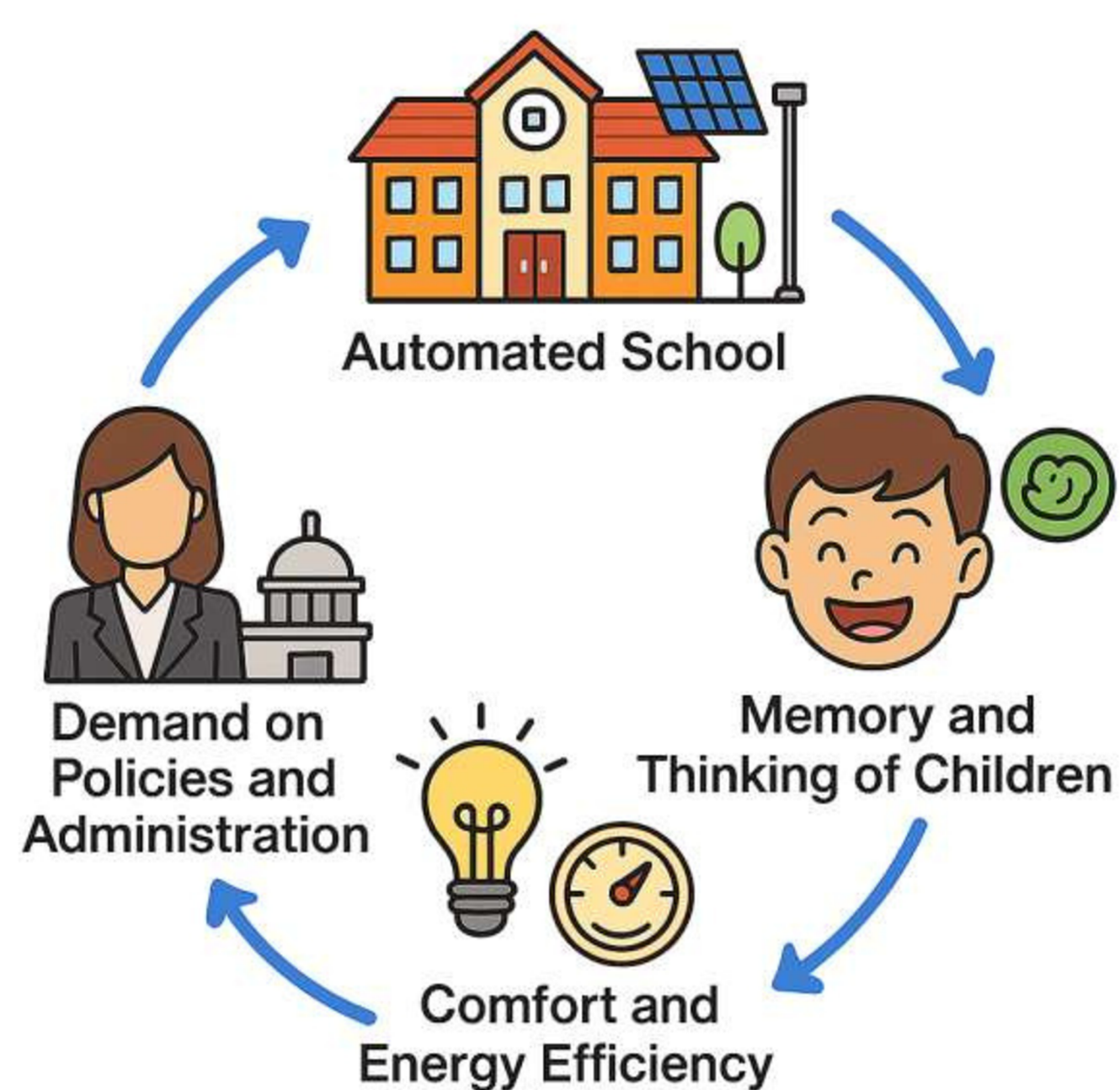


Figure 2: Activity Diagram



4. Result and Outlook

- Result: prototype dashboard concepts successfully developed for 2 student groups.
- Outlook:
 - Possibility of real-life testing in selected pilot schools.
 - Future inclusion of AI, deeper data analysis, and city level of ranking
 - Potential model for smart, sustainable schools across the EU.

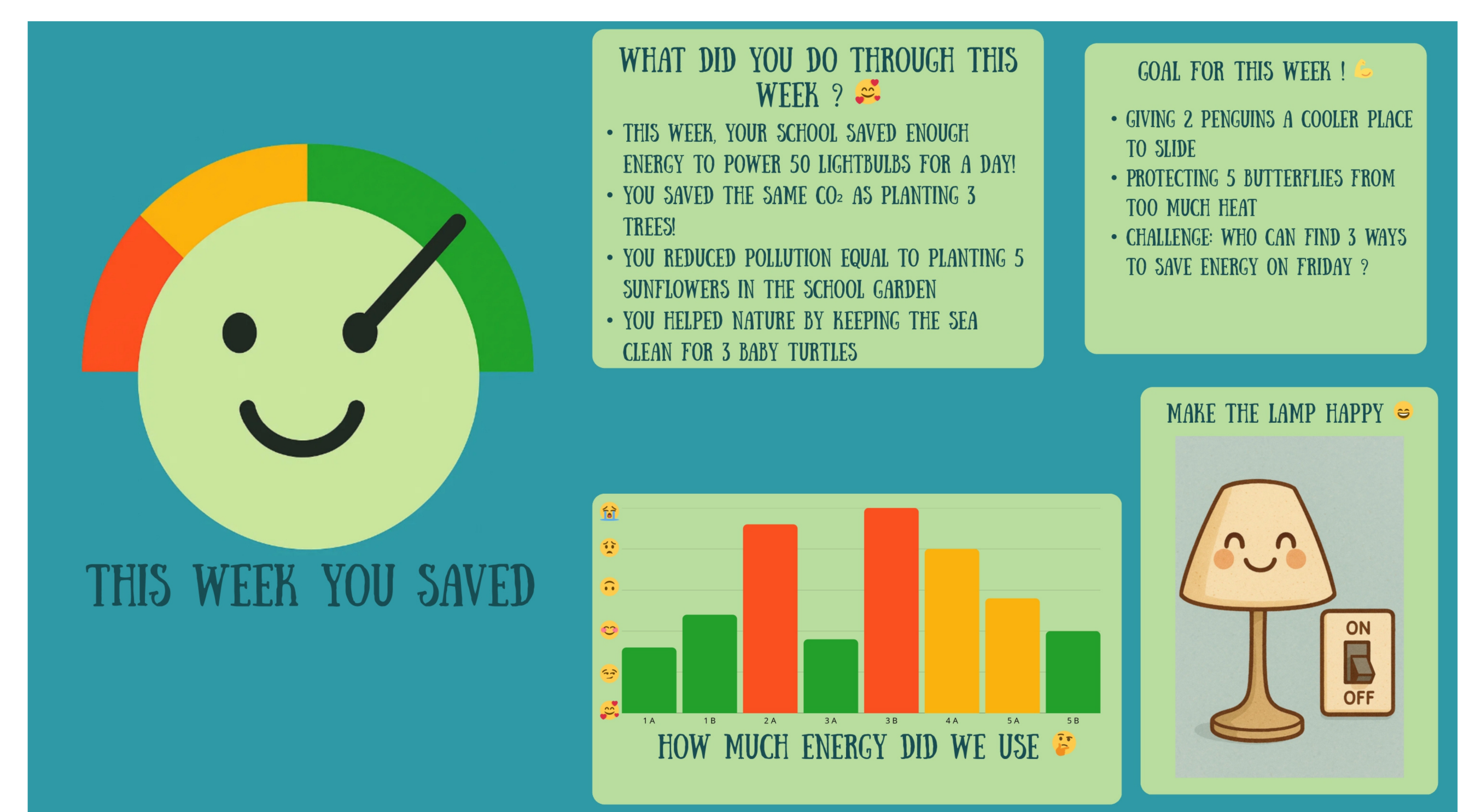


Figure 4: Visualization of dashboard for primary schools

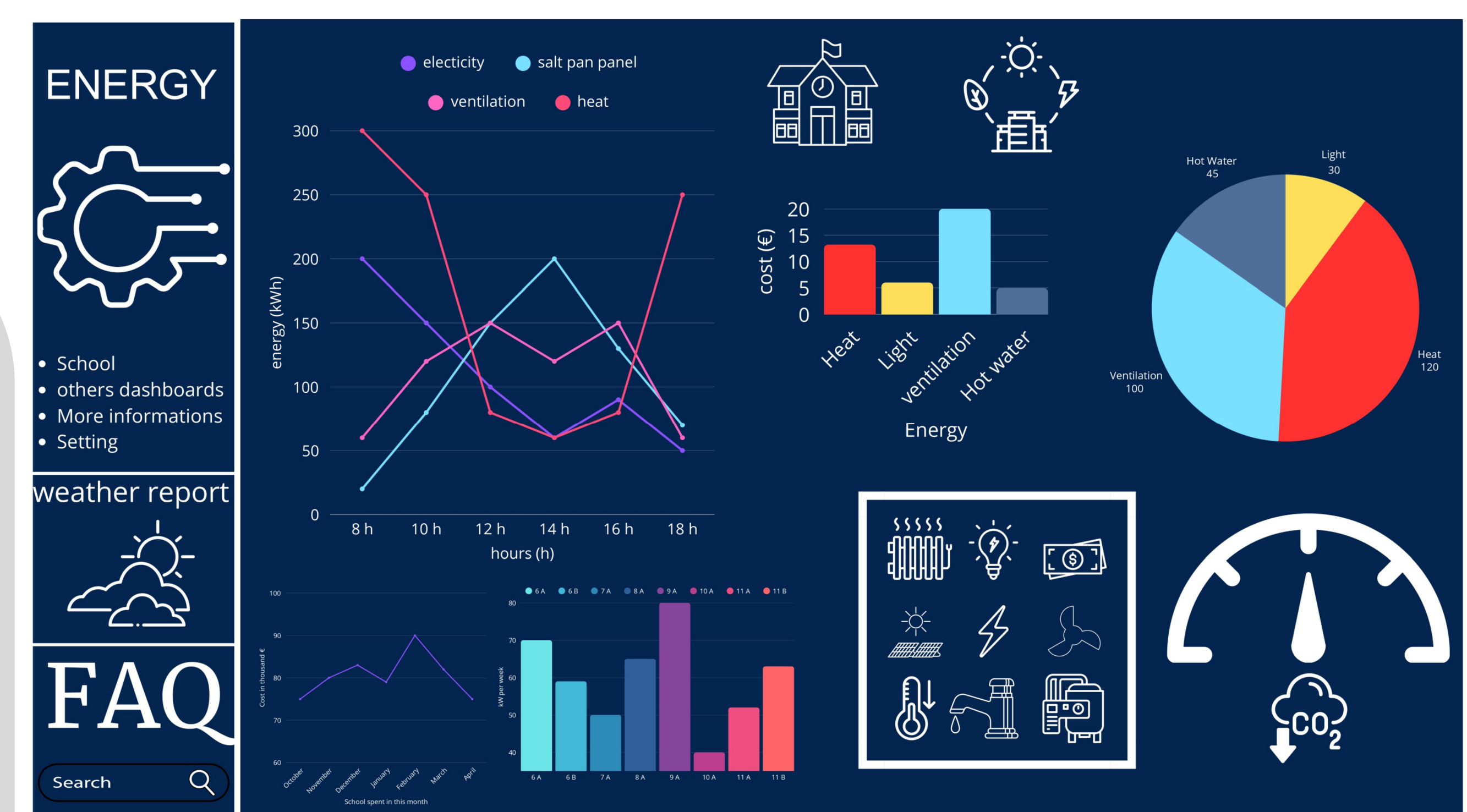


Figure 5: Visualization of dashboard for high schools

3. Discussion

- Importance of addressing **diverse user needs**: younger children need visual, gamified dashboards, older students can interpret more serious data.
- Accessibility and affordability are key to **social acceptance**—public funding plays a crucial role.
- Smart school systems not only save energy but also **educate and influence behavioral change** in young generations.
- Potential for ripple effects: from **classroom-level change** to **broader community impact**.

5. References

- [1] DigitalPakt Schule: <https://digitalpaktschule.de>
- [2] KfW Förderbank: <https://www.kfw.de>
- [3] United Nations SDGs: <https://sdgs.un.org/goals>
- [4] Home Assistant documentation: <https://www.home-assistant.io>
- [5] Average School Electricity Bill: How Much Energy Do Schools Use? Colby Ezell December 8, 2021 <https://www.costanalysts.com/average-school-electric-bill/>
- [6] Gathering and processing energy consumption data from public educational buildings over IPv6 Kostas Koumoutsos, Aristotelis Kretsis, Panagiotis Kokkinos, Emmanouel A Varvarigos, Vassilis Nikolopoulos, Eirini Gkioxi and Anastatios Zafeiropoulos. December 2015
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